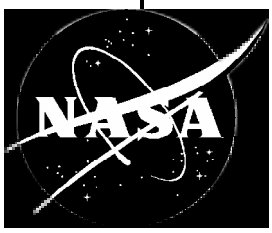
540-032

MISSION OPERATIONS AND DATA SYSTEMS DIRECTORATE

Interface Control Document (ICD) Between the Earth Observing System (EOS) Data and Information System (EOSDIS) Backbone Network (EBnet) and Distributed Active Archive Centers (DAAC)

September 1997



National Aeronautics and Space Administration

Goddard Space Flight Center
Greenbelt, Maryland

Interface Control Document (ICD) Between the Earth Observing System (EOS) Data and Information System (EOSDIS) Backbone Network (EBnet) and Distributed Active Archive Centers (DAAC)

September 1997

Prepared Under Contract NAS5-31500
Task Assignment 46 505

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Preface

This document is under the configuration management of the National Aeronautics and Space Administration (NASA) Communications (Nascom) Division Configuration Control Board (CCB).

Proposed changes to this document shall be submitted to the Nascom CCB, along with supportive material justifying the change. Changes to this document shall be made by Document Change Notice (DCN) or by complete revision.

Questions concerning this document and proposed changes shall be addressed to:

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Abstract

This Interface Control Document (ICD) describes interface agreements between the Distributed Active Archive Centers (DAAC) and Earth Observing System (EOS) Data and Information System (EOSDIS) Backbone Network (EBnet).

Keywords: *DAAC, EBnet, ICD, Interface Control Document*

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Document History			
Document Number	**Status/Issue**	**Publication Date**	**CCR Number**
540-032	DCN 001	September 1997	505-01-36-027

DCN Control Sheet

DCN Number	Date/Time Group (Teletype Only)	Month/ Year	Section(s) Affected	Initials
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Section 1. Introduction

1.1 Authority and Responsibility

The Mission Operations and Data System Directorate (MO&DSD) has the authority to implement the Earth Observing System (EOS) Data and Information System (EOSDIS) Backbone Network (EBnet). This authority was granted to MO&DSD by the EOS project under the Office of Mission to Planet Earth (Code Y). The EBnet project is under the National Aeronautics and Space Administration (NASA) Communications (Nascom) Division of the MO&DSD.

Code 540 will provide an operational communications network to support high-speed network communications between EBnet and non-EBnet hosts. The primary responsibility for this project has been assigned to the Nascom Division, Code 540. The system requirements are documented by the references in Section 2.1.

1.2 Purpose

The purpose of this document is to provide a detailed definition of the interface(s) between the EOSDIS Core System (ECS) DAACs and EBnet. EBnet will support connectivity among all of the ECS DAACs (except the Oak Ridge National Laboratory [ORNL] DAAC), connectivity between the DAACs and the Systems Monitoring and Coordination Center (SMC), and connectivity between the DAACs and other data product systems including the Landsat Processing System (LPS), Tropical Rainfall Measuring Mission (TRMM) Science Data and Information System (TSDIS), Science Data Processing Facility (SDPF), and the National Oceanic and Atmospheric Administration (NOAA) Affiliated Data Center (ADC). All data flows into and out of the ECS DAACs that are supported by EBnet are considered to be science traffic [for purposes of EBnet Interface Control Documents (ICDs), any traffic type which is not real time is considered to be science traffic].

1.3 Scope

This ICD defines and controls the functions, communications protocol(s), frame formats, and electrical characteristics of the interfaces between EBnet-provided equipment, software, and communications paths and other entities that directly interface with the network. Interfaces provided by Nascom are included in the scope of this document. Interfaces between EBnet users and other systems not provided by Nascom are not within the scope of this document.

1.4 Time Frame

This ICD shall be in effect from the date of the last approval signature.

1.5 Goals and Objectives

The goals of EBnet are to:

a. Implement an operational, integrated, transparent communications system that serves the data communications needs of projects supported by NASA Goddard Space Flight Center (GSFC), and users outside the MO&DSD.

b. Expand using industry standard system solutions while maintaining compatibility with the existing network and user interfaces.

c. Minimize costs for implementation, operation, and maintenance of the network.

d. Minimize life-cycle costs.

e. Maintain high availability by designing with redundancy, and without single points of failure in the Network Backbone, where required.

f. Utilize state-of-the-art technology, utilizing equipment with the best price-performance available commercially.

g. Allow for growth, adaptability to changing requirements, infusion of new technology, and upgraded interfaces throughout the life-cycle.

1.6 Standards Precedence

EBnet will be based on Government, commercial, and international standards. In case of conflict, the following precedence (in descending order) applies:

- This EBnet ICD.
- Government standards.
- Commercial and/or international standards.

1.7 Document Organization

Section 2 contains parent, applicable, and reference documents related to this ICD.

Section 3 details a systems overview of the EBnet, DAAC sites, and the interrelationship.

Section 4 describes the EBnet system architecture and identifies the standards supported at each level of the International Organization for Standardization (ISO) model.

Section 5 describes the facilities and maintenance demarcation.

A list of abbreviations and acronyms is provided at the end of the document.

Section 2. Related Documentation

2.1 Parent Documents

[1] *Earth Observing System AM-1 Detailed Mission Requirements*, Goddard Space Flight Center (GSFC), 505-10-33, November 1996

[2] *Earth Science Data Information System (ESDIS) Project Level 2 Requirements Volume 6, EOSDIS Backbone Network (EBnet) Requirements*, Goddard Space Flight Center (GSFC) 505-10-01-6, Revision A, December 1996

[3] *Earth Observing System (EOS) Data and Information System (EOSDIS) Backbone Network (EBnet) Interface Requirements Document (IRD)*, September 1997

[4] Reserved

2.2 Applicable Documents

[5] *Electrical Characteristics of Balanced Voltage Digital Interface Circuits*, Electronic Industries Association (EIA) 422-A, December 1978

[6] *General-Purpose 37-Position and 9-Position Interface for Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange*, EIA 449, November 1977

[7] *Internet Protocol (IP): DARPA Internet Program Protocol Specification*, Request for Comment (RFC) 791, September 1981

[8] *The Point-to-Point Protocol (PPP)*, RFC 1661, July 1995

[9] *An Ethernet Address Resolution Protocol or Converting Network Protocol Addresses to 48-bit Ethernet Addresses for Transmission on Ethernet Hardware*, RFC 826, November 1982

[10] *Internet Control Message Protocol*, RFC 792, September 1981

[11] *Routing Information Protocol (RIP)*, RFC 1058

[12] *Open Shortest Path First (OSPF)*, RFC 1247

[13] *Internet Group Multicast Protocol (IGMP)*, RFC 1112

[14] *On the Assignment of Subnet Numbers*, RFC 1219

[15] *Simple Network Management Protocol (SNMP)*, RFC 1157

[16] *Address Resolution Protocol (ARP)*, RFC 826

[17] *A Reverse Address Resolution Protocol (RARP)*, RFC 903

[18] *Internet Protocol on Ethernet Networks*, RFC 894

[19] *Transmission of IP over FDDI*, RFC 1188

[20] *Structure of Management Information*, RFC 1155

[21] *Management Information Base - II*, RFC 1213

[22] *Transmission Control Protocol*, RFC 793

[23] *Telnet Protocol*, RFCs 854 & 855

[24] *File Transfer Protocol*, RFC 959

[25] International Organization for Standardization (ISO) 9314-1, *FDDI Physical Layer Protocol (PHY)*

[26] ISO 9314-2, *FDDI Media Access Control (MAC) Protocol*

[27] ISO 9314-3, *FDDI Physical Layer Medium Dependent (PMD)*

[28] ISO 8802-2, *Logical Link Control (LLC)*

[29] ISO 8802-3, *Carrier-Sense Multiple-Access with Collision Detection (CSMA/CD) Media Access Control (MAC) - Ethernet version 2*

[30] Institute of Electrical and Electronic Engineers (IEEE) 802.3 *10Base-T (twisted pair)*

[31] IEEE *10Base5 (thick Ethernet)*

[32] International Telegraph and Telephone Consultative Committee (CCITT) *V.35*

2.3 Reference Documents

[33] *NASA Communications (Nascom) Access Protection Policy and Guidelines*, 541-107, Revision 3, GSFC, November 1995

[34] *NASA Communications System Acquisition and Management*, NASA Management Instruction (NMI) 2520.1D, National Aeronautics and Space Administration (NASA), November 18, 1991

[35] *Nascom IONET Users Guide*, 541-225, Revision 1, April 1996

Section 3. Systems Overview

3.1 EBnet General System Description

The EBnet provides wide-area communications circuits and facilities between and among various EOS Ground System (EGS) elements to support mission operations and to transport mission data between EOSDIS elements. The relationship of EBnet to other elements supporting EOS is shown in Figure 3-1. EBnet is responsible for transporting spacecraft command, control, and science data nationwide on a continuous basis, 24 hours a day, 7 days a week. The EBnet capability to transport these diverse types of data is implemented as two distinct subnetworks referred to as "real-time" and "science" networks. The real-time network transports mission-critical data related to the health and safety of on-orbit space systems and raw science telemetry as well as pre-launch testing and launch support. This highly redundant network provides an operational availability of 0.9998 with a Mean Time to Restore Service (MTTRS) of 1 minute. The science network transports data collected from spacecraft instruments and various levels of processed science data including expedited data sets, production data sets, and rate-buffered science data. The science network provides an operational availability of 0.98 with a MTTRS of 4 hours.

EBnet provides three options for accessing the Internet Protocol (IP)-based EBnet transport service: Local Area Network (LAN) Ethernet, LAN Fiber Distributed Data Interface (FDDI), and Wide Area Network (WAN) carrier service. Figure 3-2 shows an example of each of these types of interface/demarcation points to EBnet users. This ICD describes the EBnet/DAAC interface which uses the WAN and/or LAN interface types.

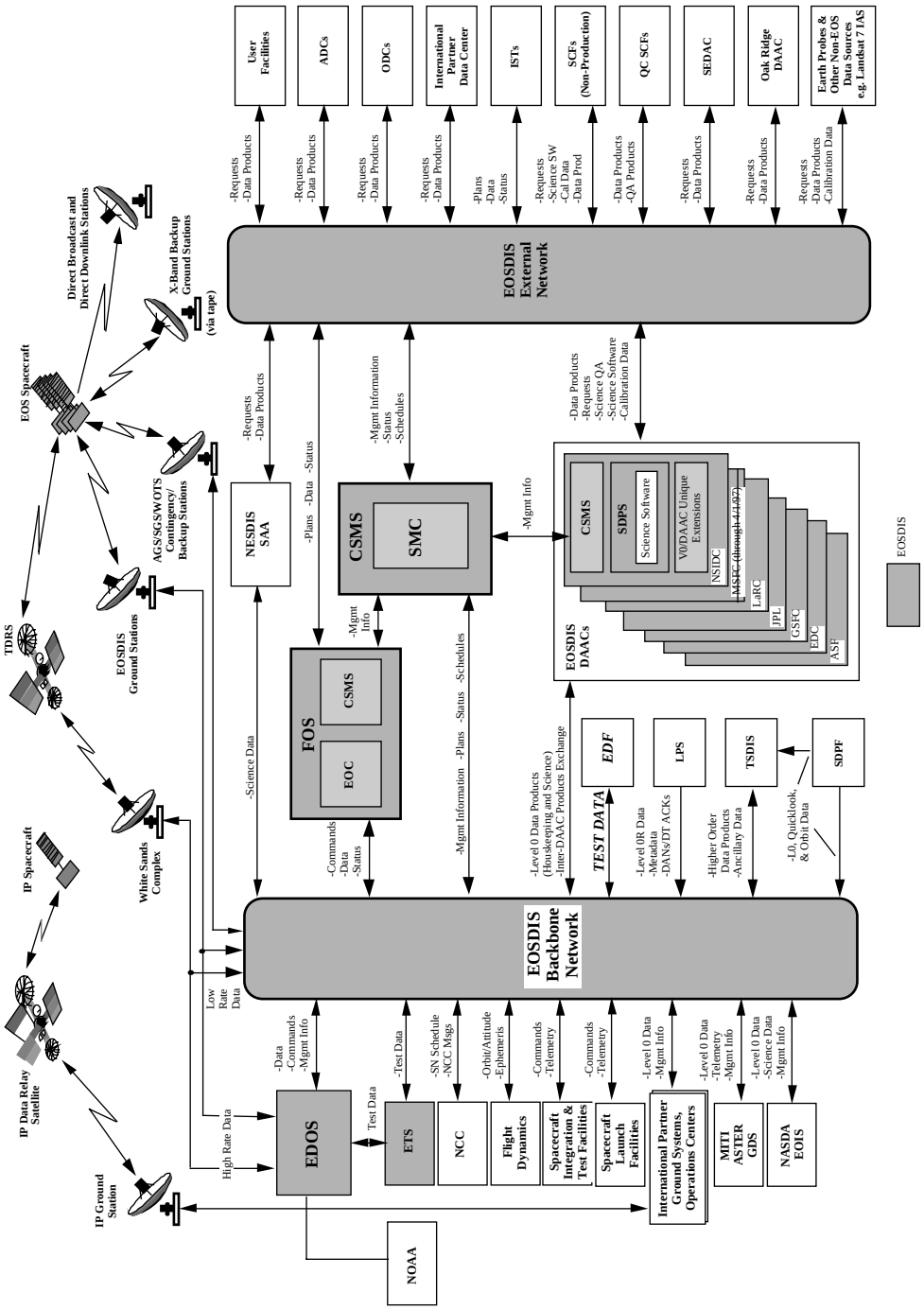

Figure 3-1. EOS Ground System

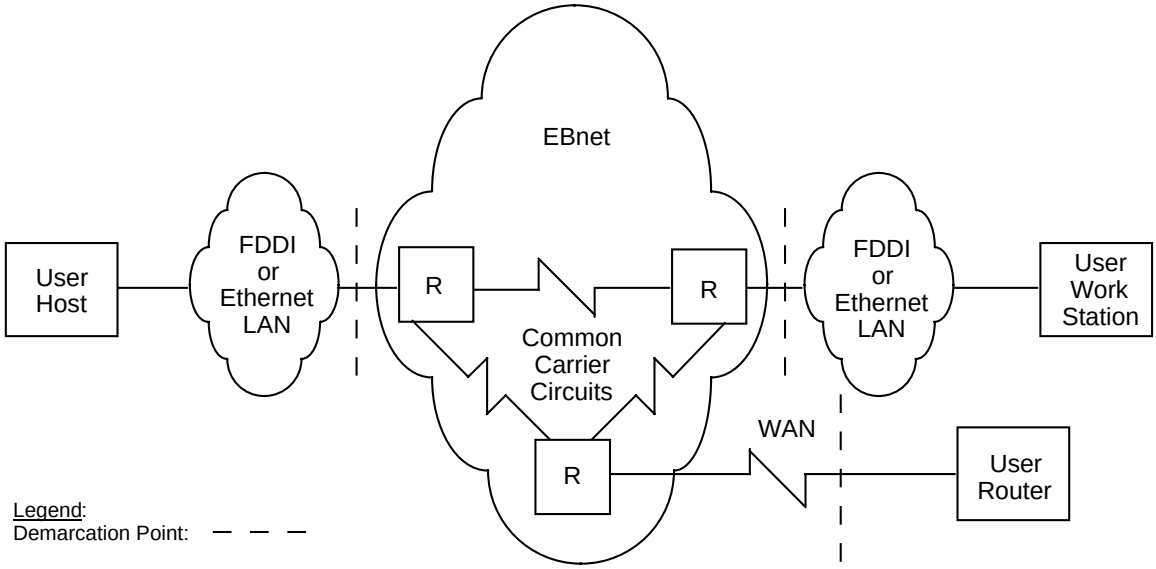

Figure 3-2. EBnet Demarcations

Sustaining engineering, preventive and remedial maintenance, and network monitoring services are provided for EBnet equipment, to ensure that EBnet keeps pace with technology and standards, and provides continuous service. The official point of contact for EBnet operational status is the Nascom Communications Manager (COMMGR) (301-286-6141). Users who detect a network problem are urged to immediately report it to the COMMGR. The COMMGR may also provide users with limited information about maintenance and status actions. Refer to the Nascom IP Operational Network (IONET) User Guide (541-225) for information regarding user connections, security guidelines, and maintenance information.

3.2 DAAC Site Descriptions

The ESDIS DAACs will exchange production and reprocessing data flows for TSDIS, AM-1, Sea Winds Sensor (SWS), Dual Frequency Altimeter (DFA), and Data Assimilation System (DAS). User Query and Query-Response data flows will be exchanged. The architecture for the DAAC sites [GSFC, Langley Research Center (LaRC), and EROS Data Center (EDC), Jet Propulsion Laboratory (JPL), and National Snow and Ice Data Center (NSIDC)] are presented in Section 4.1. The Alaska SAR Facility (ASF) site design has been postponed due to ongoing EOSDIS analysis of the ASF DAAC.

3.3 Relationship Between DAACs and EBnet

EOS researchers and the general science community will not connect to the DAACs through EBnet, but instead through the NASA Internet (NI). Connections to the V0 network will be made through separate serial interfaces for security reasons. The EBnet connection to projects currently on the MO&DSD Operational/Development Network / Nascom Operational Local Area Network (MODNET/NOLAN) network will be made through the MODNET Open Segment. Management interfaces between DAAC and EBnet management systems are described in the ICD between EBnet and the SMC. EBnet will support all inter-DAAC communications for all DAACs listed in this document.

Section 4. Interface Detailed Design

4.1 Interface Design Overview

EBnet will maintain a router at each EBnet-supported DAAC location, including the GSFC, LaRC, EDC, NSIDC, and JPL DAACs. The router will be connected to the DAAC's ECS Pre-Release B Testbed Network and Release B Production and Ingest Networks as needed. A cost-effective topology that will support ESDIS requirements without degradation of service will be provided. This network topology will change based on: changing requirements; or as additional requirements are levied when future instruments become active.

Connectivity to the GSFC ECS DAAC Network and the NI/Program Support Communication Network-Internet (PSCNI) networks will be provided by high-speed links between EBnet routers. The EBnet router will support four FDDI links, one each to the ECS Pre-Release B Testbed Ingest Network, Pre-Release B Testbed Production Network, Release B Ingest Network and Release B Production Network.

The LaRC ECS DAAC Network will connect to GSFC via EBnet-supplied multiple T3 links for the Release B time frame. The EBnet router (which will be replacing the MODNET/NOLAN router) will support four FDDI links one each to the ECS Pre-Release B Testbed Ingest Network, Pre-Release B Testbed Production Network, Release B Ingest Network and Release B Production Network.

Redundant EBnet routers are located at EDC to support the Landsat 7 interface to the EDC ECS DAAC. The primary router will support one FDDI link to the Landsat 7 system, one FDDI link each to the ECS Release B Ingest and Production Networks. The backup router will support one FDDI link to the Landsat 7 system and one FDDI link to the ECS Release B Ingest Network. In addition, EBnet router supports a single ethernet connection to the ECS Pre-Release B Testbed.

The EBnet router located at NSIDC will support one FDDI link to the ECS Release B Production Network. In addition, EBnet router supports a single ethernet connection to the ECS Pre-Release B Testbed.

The EBnet router located at JPL will support two FDDI links, one to the ECS Release B Ingest Network and one to the ECS Release B Production Network.

The EBnet router located at the ECS Development Facility (EDF) will support one FDDI link to the EDF Mini DAAC and one FDDI link to the EDF Verification Acceptance Test Center (VATC) DAAC.

4.2 Design Assumptions

ESDIS transfers no real-time data to remote WAN locations.

EBnet will provide network management using Simple Network Management Protocol (SNMP), including monitoring and control, for all EBnet-provided equipment (routers, concentrators, etc.).

EBnet routers will provide filters to support security on an IP subnet basis. No service or port-level filters will be supported.

4.3 Overview of System Interfaces

The following sections detail the standards that will be supported at each level of the ISO seven-layer model.

4.3.1 ISO Layer One Interface Control (Physical Layer)

EBnet will support the following physical layer connections from the DAAC sites:

a. ISO 9314-1, FDDI Physical Layer Protocol (PHY).

b. ISO 9314-3, FDDI Physical Layer Medium Dependent (PMD).

c. Institute of Electrical and Electronic Engineers (IEEE) 802.3 *10Base-T (twisted pair).*

d. IEEE *10Base5 (thick Ethernet).*

4.3.2 ISO Layer Two Interface Control (Data Link Layer)

EBnet will support the following data link layer protocols from DAAC sites:

a. ISO 9314-2, FDDI Media Access Control (MAC) Protocol.

b. ISO 8802-2, *Logical Link Control (LLC).*

c. ISO 8802-3, *Carrier-Sense Multiple-Access with Collision Detection (CSMA/CD) Media Access Control (MAC) - Ethernet version 2.*

4.3.3 ISO Layer Three Interface Control (Network Layer)

EBnet will support the following network layer protocols from DAAC sites:

a. RFC 791, Internet Protocol Version 4.0.

b. RFC 826, Address Resolution Protocol (ARP).

c. RFC 903, Reverse Address Resolution Protocol (RARP).

d. RFC 1058, Routing Information Protocol (RIP).

e. RFC 1247, Open Shortest Path First (OSPF).

4.3.4 ISO Layer Four Interface Control (Transport Layer)

EBnet will support transparent communication at the transport layer.

4.3.5 ISO Layer Five Interface Control (Session Layer)

EBnet will support transparent communication at the session layer.

4.3.6 ISO Layer Six Interface Control (Presentation Layer)

EBnet will support transparent communication at the presentation layer.

4.3.7 ISO Layer Seven Interface Control (Application Layer)

EBnet will support transparent communication at the application layer.

4.3.8 Network/Station Management Protocols

EBnet shall support, at a minimum, the following management protocols:

a. SNMP.

b. FDDI Station Management (SMT) 6.2 or higher.

4.4 Routing and Addressing Guidelines

EBnet will be internetworked by routers which will be configured to support only the IP, and will provide isolation for separate networks. Cisco 7500, 4700, and Bay Networks BCN routers have been chosen to provide network access to users.

EBnet will utilize standard IP addressing conventions. EBnet will provide Class C addresses to each connected user. The IP addresses assigned to the DAAC sites are shown in Table 4-1. The address space allocations are shown in figures specified in Table 4-1. EBnet will not advertise DAAC routes to the Internet. The EBnet router will use the first host address and the DAAC will use the second host address of the specified Class C for each DAAC to EBnet interface.

4.5 Data Flow Requirements

The purpose of the interface between the DAACs and EBnet is to support connectivity between DAAC and DAAC-associated sites. All DAAC data flows supported by EBnet are solely science traffic. The DAAC data flows are derived from the EBnet Traffic Database.

Table 4-1. DAAC IP Address and Subnet Assignments

Site	Mask	IP Subnet	DAAC Element
GSFC	.0	198.118.192.0	Pre Release B Testbed
	.224	198.118.193.32	Pre Release B Testbed
	.224	198.118.193.64	EBnet router to Pre Release B Testbed Switch
	.224	198.118.194.32	Pre Release B Testbed SMC
	.0	198.118.198.0	DAAC M&O
	.0	198.118.210.0	Release B Production
	.224	198.118.211.32	Release B Ingest
	.224	198.118.211.64	EBnet Router to Release B Switch
	.224	198.118.212.32	Release B SMC
	.224	198.118.212.64	Release B user Network
	.224	198.118.212.96	Release B User Network
	.224	198.118.212.128	EBnet Router to Release B Router
	.224	198.118.212.160	Release B SMC BBS
	.224	198.118.212.192	ECS Router to EOC
LaRC	.0	198.118.214.0	Pre-Release B Testbed
	.0	198.118.216.0	Pre-Release B Testbed
	.0	198.118.217.0	Release B Ingest
	.0	198.118.218.0	Release B User Network
	.0	198.118.219.0	Release B Production
	.252	198.118.223.56	EBnet Router to ECS Switch

Table 4-1. DAAC IP Address and Subnet Assignments (Continued)

Site	Mask	IP Subnet	DAAC Element
EDC	.0	198.118.202.0	Release B Production
	.0	198.118.203.0	Release B User Network
	.224	198.118.204.32	EBnet Router to ECS Switch
	.224	198.118.204.64	Release B Ingest
	.224	198.118.204.96	LPS
	.192	198.118.224.64	Pre-Release B Testbed
NSIDC	.0	198.118.205.0	Release B Production
	.192	198.118.206.64	Release B User Network
	.192	198.118.206.128	Release B DAAC M&O
	.224	198.118.225.32	Pre-Release B Testbed
	.252	198.118.223.44	EBnet Router to ECS Switch
JPL	.224	198.118.207.0	Release B Ingest
	.0	198.118.208.0	Release B Production
	.192	198.118.209.64	Release B User Network
	.192	198.118.209.128	DAAC M&O
	.252	198.118.223.48	EBnet Router to ECS Switch
EDF	.192	198.118.232.0	VATC DAAC Production
	.192	198.118.233.128	VATC DAAC SMC
	.192	198.118.233.64	VATC User Network

Section 5. Facilities and Maintenance Demarcation

5.1 Equipment Location

The location of the router equipment is as follows:

GSFC	Bldg. 32, Rm. C210H.
LaRC	Bldg. 1201, Rm. 115C.
EDC	Rm. B6.
NSIDC	Rm. 261.
JPL	Bldg. 230, Rm. B4.

5.2 Maintenance Demarcation

The demarcation point between EBnet maintenance and DAAC maintenance is the connection at the EBnet router. Cabling will be provided and maintained by the ECS DAAC implementor.

Abbreviations and Acronyms

ADC	Affiliated Data Center
ARP	Address Resolution Protocol
ASF	Alaska SAR Facility
Bldg.	Building
CCB	Configuration Control Board
CCITT	International Telegraph and Telephone Consultative Committee
CSMA/CD	Carrier-Sense Multiple-Access with Collision Detection
DAAC	Distributed Active Archive Center
DAS	Data Assimilation System
DCN	document change notice
DFA	Dual Frequency Altimeter
EBnet	EOSDIS Backbone Network
ECS	EOSDIS Core System
EDC	EROS Data Center
EGS	EOS Ground System
EIA	Electronic Industries Association
EOS	Earth Observing System
EOSDIS	EOS Data and Information System
EROS	Earth Resources Observation System
ESDIS	Earth Science Data and Information System
FDDI	Fiber Distributed Data Interface
GSFC	Goddard Space Flight Center
ICD	Interface Control Document
IEEE	Institute of Electrical and Electronic Engineers
IONET	IP Operational Network
IP	Internet Protocol
IRD	Interface Requirements Document

ISO	International Organization for Standardization
JPL	Jet Propulsion Laboratory
LAN	local area network
LaRC	Langley Research Center
LLC	Logical Link Control
LPS	Landsat Processing System
MAC	Media Access Control
MO&DSD	Mission Operations and Data Systems Directorate
MTTRS	Mean Time to Restore Service
NASA	National Aeronautics and Space Administration
Nascom	NASA Communications
NOAA	National Oceanic and Atmospheric Administration
NI	NASA Internet
NSIDC	National Snow and Ice Data Center
OSPF	Open Shortest Path First
PHY	Physical Layer Protocol
PMD	Physical Layer Medium Dependent
PSCNI	Program Support Communication Network-Internet
RARP	Reverse Address Resolution Protocol
RFC	Request for Comment
RIP	Routing Information Protocol
Rm.	Room
SDPF	Science Data Processing Facility
SMC	Systems Monitoring and Coordination Center
SMT	Station Management
SNMP	Simple Network Management Protocol
SWS	Sea Winds Sensor
TRMM	Tropical Rainfall Measuring Mission
TSDIS	TRMM Science Data and Information System

WAN	Wide Area Network